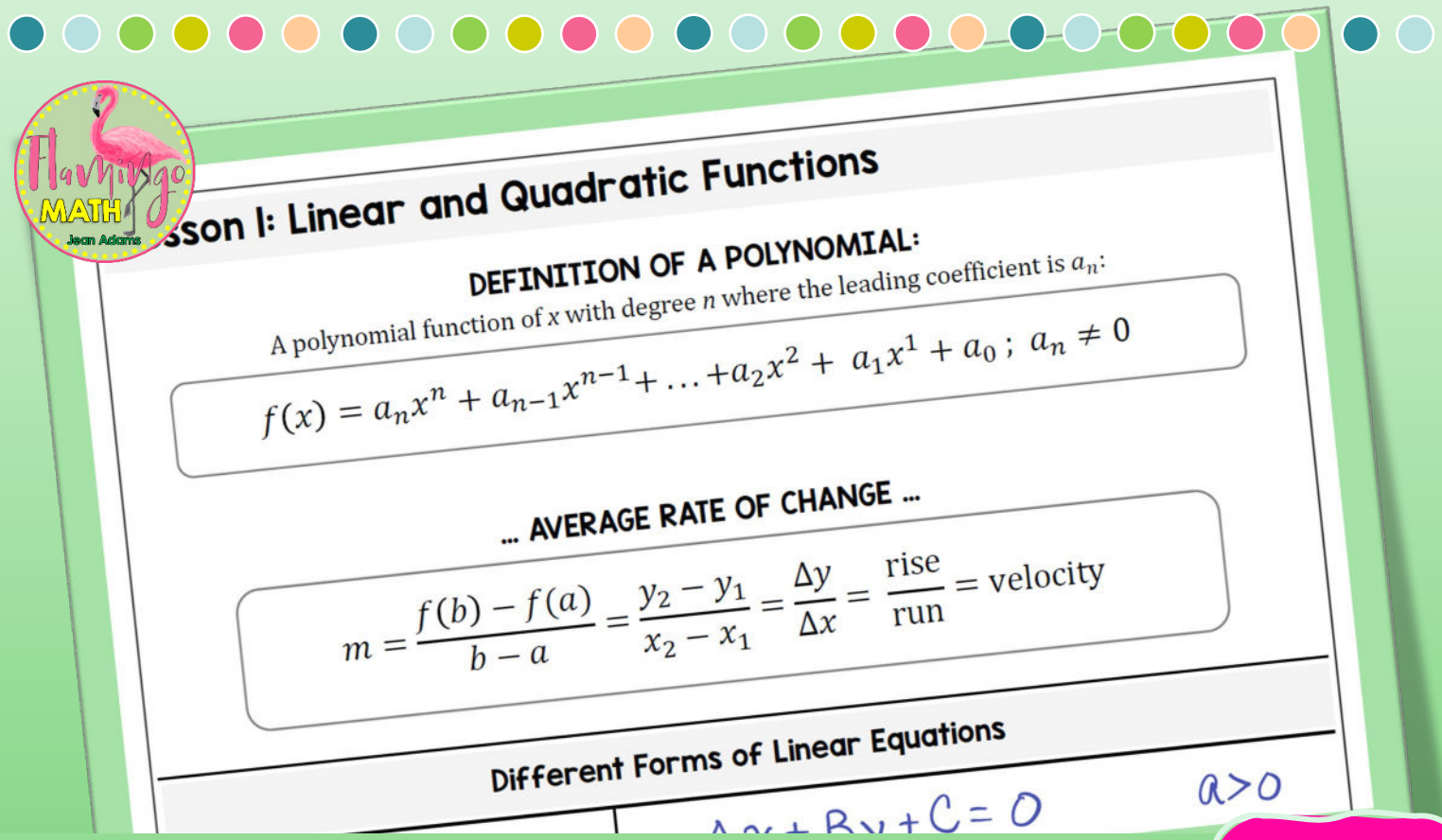
Precalculus Honors

Linear & Quadratic Functions



Completely Editable

2.1

Lesson I: Linear and Quadratic Functions

DEFINITION OF A POLYNOMIAL:

A polynomial function of x with degree n where the leading coefficient is a_n:

$$f(x) = a_n x^n + a_{n-1}x^{n-1} + \ldots + a_2 x^2 + a_1 x^1 + a_0 \; ; \; a_n \neq 0$$

... AVERAGE RATE OF CHANGE ...

$$m = \frac{f(b) - f(a)}{b - a} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}} = \text{velocity}$$

Different Forms of Linear Equations

1. General Form:	
2. Slope-Intercept Form:	

EX #2: Write an equation in slope-intercept form for the linear function, f, such that $f(-4) = 9$ and $f(0) = 3$.

EX #3: Write an equation in point-slope form for the linear function, g, such that $g(5) = 7$ and $g(3) = -3$.

Quadratic Functions and Their Graphs

A quadratic function is a polynomial function of degree _____.

The shape of the graph is called a _____.

Characteristics of a Quadratic

Perfect Square Trinomial

The middle term is **twice the product** of the binomial's first and last term.

$(x + a)^2 =$

$(x - a)^2 =$

Steps to Complete the Square

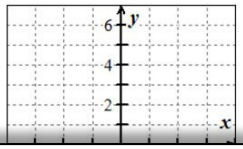
Can you state a procedure to follow if you convert from standard form to vertex form using the technique of completing the square?

1. _____
2. _____
3. _____
4. _____

EX #5: Use completing the square to describe the graph of $f(x) = 2x^2 + 4x - 1$. Support your answer graphically. Analyze the function completely.

Window:

Vertex: _____



Application

EX #6: The Surfside Little League uses a baseball pitching machine to help train players to catch a high fly ball. It throws baseballs straight up with an initial velocity of 36 ft/sec from a height of 4.5 feet.

A. Find an equation that models the height of the ball t seconds after it is thrown.

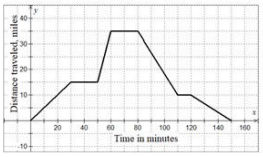
B. What is the maximum height the baseball will reach?

C. How many seconds will it take to reach that height?

D. How much time is the ball in the air?

Analyze Graph Application

EX #7: The **position vs time graph** below (Figure A), shows the distance an object travels on the interval $0 \leq x \leq 150$ minutes.



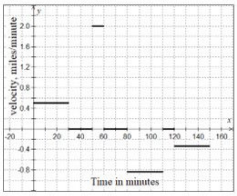
[Figure A]

a) When is the particle at rest?

b) When is the particle moving left?

c) When does the particle change directions?

EX #8: The **velocity vs time graph** below (Figure B), shows the velocity of an object on the interval $0 \leq x \leq 150$ minutes.



a) When is the particle at rest?

b) When is the particle moving left?

c) When does the particle change directions?

NOTES

2.1 Linear and Quadratic Functions Homework

Name _____

Date _____ Period _____

Problems 1 – 2, Determine which are polynomial functions and state the degree and leading coefficient. For those that are not, explain why not.

1. $y = -5 + 3.2x$

Degree: _____

Leading Coefficient: _____

Is this a polynomial? Yes No

2.. $h(x) = \sqrt{5x^4 - x^2}$

Degree: _____

Leading Coefficient: _____

Is this a polynomial? Yes No

Problems 3 – 4, Write an equation, in the form specified, for the linear function satisfying the given information.

3. Slope-Intercept Form

$f(-4) = 14$ and $f(4) = -4$

4. Point-Slope Form

$f(-1) = 11$ and $f(6) = -10$

Problems 5 – 8, Find the vertex and axis of symmetry. Then rewrite the equation in vertex form.

5. $f(x) = 4x^2 - 2x + 6$

6. $g(x) = 2x^2 + 7x - 2$

7. $h(x) = 8x - 3 - x^2$

8. $f(x) = 3x^2 - 9x + 4$

Problems 9 – 12, Use completing the square to describe the graph of each function. Analyze the function, stating the domain, range, vertex, and other key features.

9. $g(x) = x^2 + 8x + 11$

10. $f(x) = -2x^2 + 16x - 29$

11. $h(x) = -x^2 + 2x + 5$

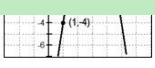
12. $f(x) = \frac{1}{2}x^2 - 2x + 5$

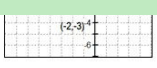
Problems 13 – 15, Solve.

13. A large oil painting is 4 feet longer than its height. There is a wooden frame around the painting that is 12 inches wide. The area of the picture and frame together is 165 ft^2. Find the dimensions of the painting. (Hint: Draw a diagram)

14. A competition was held at the Marlin's baseball stadium in Miami, FL to see who can throw a baseball the highest from the front row of the upper deck of seats 65 feet above field level. The winner threw the ball with an initial vertical velocity of 84 feet per second and it lands on the infield grass. What is the maximum height of the baseball? How much time is the ball in the air? What is the vertical velocity of the ball at impact?

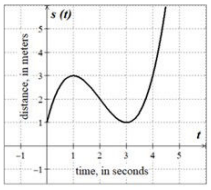
15. A boat manufacturer found that the revenue from sales of a ski-boat is a function of the unit price p that it charges. If the revenue R is $R(p) = 1600p - 0.5p^2$, what unit price p should the company charge in order to maximize revenue? What is the maximum revenue?





Free Response Question

18. The **position vs time graph** below (Figure A), shows the distance an object travels on the interval $0 \le t \le 5$ seconds.



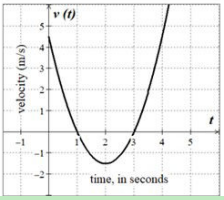
[Figure A]

a) When is the particle at rest?

b) When is the particle moving left?

c) When does the particle change directions?

19. The **velocity vs time graph** below (Figure B), shows the velocity of an object on the interval $0 \le t \le 5$ seconds.



a) When is the particle at rest?

b) When is the particle moving left?

c) When does the particle change directions?

Practice Sets

Lesson Warm-Ups

Name _____ Date _____ Period _____

Lesson 2.1: Linear & Quadratic Functions **Warm-Up # 1**

1. Write the slope intercept form of a linear function given $f(6) = 2$ and $f(3) = 1$.	**2.** Find the vertex and y-intercept of the function. $f(x) = 2x^2 - 8x + 3$
3. Write the vertex form of a parabola that has a vertex of $(2, -1)$ and passes through the point $(0,3)$.	**4.** Find standard form of the polynomial $y = \frac{1}{4}(x-4)^2 + 3$

Name _____ Date _____ Period _____

Lesson 2.1: Linear & Quadratic Functions **Warm-Up # 2**

1. Write the slope intercept form of a linear function given $f(-1) = -2$ and $f(2) = 4$.	**2.** Find the vertex and y-intercept of the function. $f(x) = -2x^2 - 8x - 4$
3. Write the vertex form of a parabola that has a vertex of $(-3, 7)$ and passes through the point $(0, -2)$.	**4.** Find standard form of the polynomial $y = \frac{1}{3}(x-3)^2 + 2$

Daily Lesson Quiz

2.1 Linear & Quadratic Functions **Form A**

Name _____

Date _____ Period _____

1. Write the slope-intercept form for the linear function given $f(-3) = 5$ and $f(6) = -1$.

2. Find the vertex and y-intercept of the function. $f(x) = -x^2 + 6x - 4$

3. Write the vertex form of the equation of the parabola that has vertex $(3, -1)$ and passes through the point $(0, 2)$.

4. Find standard form of the polynomial. $y = \frac{1}{2}(x-3)^2 - 4$

Grade:

2.1 Linear & Quadratic Functions **Form B**

Name _____

Date _____ Period _____

1. Write the slope-intercept form for the linear function given $f(4) = -8$ and $f(-8) = 1$.

2. Find the vertex and y-intercept of the function. $f(x) = -x^2 - 4x - 7$

3. Write the vertex form of the equation of the parabola that has vertex $(-1, 2)$ and passes through the point $(0, -3)$.

4. Find standard form of the polynomial. $y = \frac{1}{3}(x+2)^2 + 6$

Grade: